

**What Is Claimed Is:**

1. A combustion control device for an engine, comprising a fuel injection valve for injecting a fuel into a combustion chamber, ignition timing adjustment means for adjusting an ignition timing of a mixture inside the combustion chamber, and control means for controlling said fuel injection valve and said ignition timing adjustment means, wherein said control means controls said fuel injection valve so as to execute at least a first injection which is conducted within the interval from an intake stroke to a compression stroke and a second injection conducted in the vicinity of a compression top dead center after the execution of said first injection, and controls said ignition timing adjustment means so that the mixture formed by a fuel injected by said first injection and second injection and an intake air or the like is ignited after completion of the injection of said second injection.

2. The combustion control device for an engine according to claim 1, wherein said ignition timing adjustment means comprises exhaust gas recirculation system for circulating exhaust gas into said combustion chamber.

3. The combustion control device for an engine according to claim 1, wherein said ignition timing adjustment means comprises a variable compression ratio mechanism for changing a compression ratio by varying the capacity of said combustion chamber.

4. The combustion control device for an engine according to claim 1, wherein said ignition timing adjustment means comprises a variable valve timing mechanism for changing the compression ratio by varying the open-close timing of intake and exhaust valves.

5. The combustion control device for an engine according to claim 1, wherein said ignition timing adjustment means comprises injection means for injecting a liquid such as water or alcohol into said combustion chamber.

6. The combustion control device for an engine according to claim 1, wherein said ignition timing adjustment means comprises a spark plug provided so as to face the inside of the combustion chamber and current conduction means for igniting the mixture inside the combustion chamber by supplying an electric current to said spark plug.

7. The combustion control device for an engine according to claim 1, wherein said control means controls said ignition timing adjustment means so that the peak of the mixture concentration frequency distribution of the mixture formed by said second ignition

when the mixture present inside said combustion chamber is ignited assumes a value of two or less, as an equivalence ratio.

8. The combustion control device for an engine according to claim 1, wherein said control means determines an injection quantity and/or injection timing of said first injection so that the peak of the mixture concentration frequency distribution of the mixture formed by said first ignition when the mixture present inside said combustion chamber is ignited assumes a value of one or less, as an equivalence ratio.

9. A combustion control device for an engine, comprising a fuel injection valve for injecting a fuel into a combustion chamber, ignition timing adjustment means for adjusting an ignition timing of a mixture inside the combustion chamber, and control means for controlling said fuel injection valve and said ignition timing adjustment means, wherein said control means comprises as fuel injection modes at least:

a single-stage premix injection mode in which said fuel injection valve is controlled so as to execute one injection within the interval from an intake stroke to a compression stroke when an engine operation state is in a region with a low revolution speed and a low load; and

a multistage premix combustion mode in which said fuel injection valve is controlled so as to execute at least a first injection conducted within the interval from an intake stroke to a compression stroke and a second injection conducted in the vicinity of a compression top dead center after the execution of said first injection and said ignition timing adjustment means is controlled so that the mixture formed by a fuel injected by said first injection and second injection and an intake air or the like is ignited after the ignition end of said second injection, when the engine operation state is in a region with a higher revolution speed and a higher load than those of the region in which said single-stage premix combustion mode is executed.

10. The combustion control device for an engine according to claim 9, wherein said control means additionally comprises as said fuel injection mode a normal combustion mode in which said fuel injection valve is controlled so as to execute at least one injection in the vicinity of the compression top dead center when the engine operation state is in a region with a load higher than that of the region in which said multistage premix combustion mode is executed.

11. The combustion control device for an engine according to claim 10, wherein said ignition timing adjustment means comprises exhaust gas recirculation system for circulating exhaust gas into said combustion chamber; and  
said control means controls said fuel injection valve so as to decrease gradually an injection quantity of said first injection of said multistage premix combustion mode and to increase gradually an injection quantity of said second injection to a target injection quantity of said normal combustion mode, and controls said exhaust gas recirculation system so as to decrease gradually a return ratio of exhaust gas according to the increase in the injection quantity of said second injection when a transition is made from said multistage premix combustion mode to said normal combustion mode.

12. A combustion control method for an engine, comprising the steps of:  
executing at least a first injection which is conducted within the interval from an intake stroke to a compression stroke and a second injection conducted in the vicinity of a compression top dead center after the execution of said first injection; and  
adjusting an ignition timing of a mixture so that the mixture formed by a fuel injected by said first injection and second injection and an intake air or the like is ignited after completion of the injection of said second injection.

13. The combustion control method for an engine according to claim 12, wherein the ignition timing of said mixture is adjusted by adjusting the quantity of exhaust gas returned into the combustion chamber.

14. The combustion control method for an engine according to claim 12, wherein the ignition timing of said mixture is adjusted by changing the capacity of the combustion chamber.

15. The combustion control method for an engine according to claim 12, wherein the ignition timing of said mixture is adjusted by varying the open-close timing of intake and exhaust valves and changing a compression ratio.

16. The combustion control method for an engine according to claim 12, wherein the ignition timing of said mixture is adjusted by injecting a liquid such as water or alcohol into said combustion chamber.

17. The combustion control method for an engine according to claim 12, wherein the ignition timing of said mixture is adjusted by adjusting a current-supplying timing to a spark plug provided so as to face the inside of the combustion chamber.